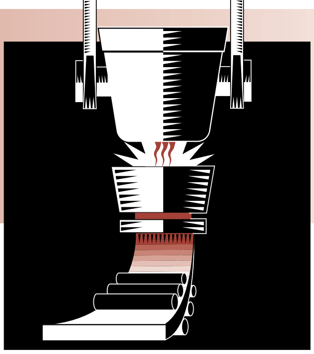
STEEL

Project Fact Sheet



Future Steelmaking Processes

Benefits

- Reduced energy consumption and emissions by 10%
- Development of a flexible process with regard to raw materials
- Improved production efficiency

Applications

Development of new technologies using a series of optimized process units to produce steel continuously may replace conventional steelmaking thus increasing production efficiency while reducing energy, emissions, and costs.

Development of a new steelmaking process may reduce energy consumption, emissions, and costs while improving production efficiency

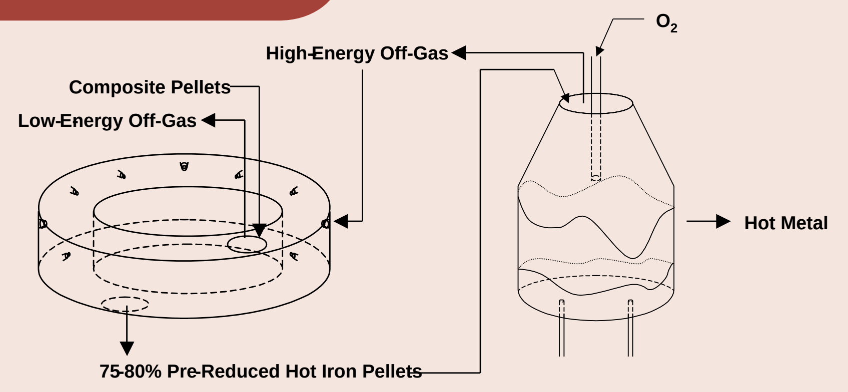
The new process to be developed should satisfy the following criteria:

- Reduce energy, CO_2 and other emissions significantly (at least 10%).
- Capital cost must be low (at least less than rebuilding a coke oven, blast furnace, basic oxygen furnace (CO-BF-BOF), a process now widely used).
- The process must be flexible with regard to raw materials including fine ore, concentrate, recycled oxides, scrap, coal, oxygen of varying purity, air, etc.
- The process should produce steel of sufficient quality for the highest quality steel.
- The process should be economical on a small scale (0.5 - 1.0 million tons per year) to feed an electric arc furnace, supplement a blast furnace, or replace a small blast furnace.

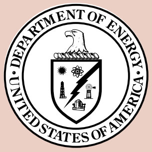
The concept of this project is to analyze steelmaking processes, combining and optimizing a series of process units to produce steel continuously. The individual units will be selected from a set of processes which have been somewhat tested, but, in general, have not been fully proven. In general, these processes cannot produce steel economically and efficiently alone, but an optimized combination may meet the overall process criteria.

Examples of individual units that will be analyzed include rotary hearth furnaces, iron smelters, continuous refining units, low shaft furnaces, etc. As an example of a process system that could be composed from these individual units consider a rotary hearth furnace (RHF) for partial reduction, a smelter for melting and final reduction, and an IRSID continuous steelmaking unit.

Schematic of an Example of Process



Process example.



Future Steelmaking Processes (Continued)

This process system could be optimized with respect to the criteria and overall process efficiency. In this example, the problems with rotary hearth furnaces (low productivity and excessive gangue) are overcome by final reduction and melting in the smelter. The problems with the smelter (energy generation and transfer) are overcome by using a highly reduced material from the rotary hearth. Energy is optimized by using the unburned CO and H_2 from the smelter and refiner in the rotary hearth.

Several other potential process systems will be analyzed. The individual units to be considered will include, but are not limited to the Rotary hearth furnace (RHF), Smelting (e.g., AISI and HIsmelt), CIRCOFER (coal-based direct reduction), Grate processes (bottom blown solid state reduction), Submerged arc furnaces (SAF), COREX, Tecnored, Energy optimizing furnace (EOF), IRSID continuous steelmaking, AISI continuous desulfurization, and IFCON (direct to steel process).

The use of current processing units such as the electric arc furnace (EAF) and basic oxygen furnace (BOF) will also be considered.

Project Description

Goal: To examine and design a revolutionary steelmaking process of which will reduce energy, emissions, and costs.

This is a two-year project with Carnegie Mellon University the recipient of the award. The project team will examine several possible process unit combinations and select possibly two or three process systems to be examined in detail.

Progress and Milestones

Specifically, the program will include the following tasks:

Project start date, September 2001; Project completion date, September 2003.

Task 1. Define Process Units
The individual process units that will be combined will be clearly defined and limitations for each of these identified. Completion Date: June 2002.

Task 2. Screen Potential Systems
Potential process systems made up of two or more of the individual units will be screened by performing initial calculations indicating the merits of the new process system. Two or three of the most promising systems will be selected for more detailed analysis and optimization. Completion Date: June 2002.

Task 3. Develop Energy and Material Balances
Energy and material balance computer models will be developed for the units being considered. Completion Date: December 2002.

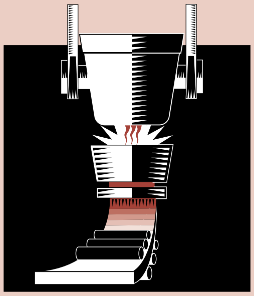
Task 4. Develop Process Kinetic Models
Process kinetic models will be developed to determine the productivity of individual units. These models will be fairly simple and crude, but will allow for extrapolation of productivity data to other conditions. Completion Date: April 2003.

Task 5. Optimize Processes
Using the results of Tasks 3 and 4, the systems selected in Task 2 will be optimized. Completion Date: June 2003.

Task 6. Link Processes
Materials handling and other process links will be considered for the selected systems. Completion Date: September 2003.

Task 7. Perform Economic and Environmental Analysis
An economic and environmental analysis will be performed for the selected systems. Variations in the process system to meet different objectives will be considered.
Completion Date: September 2003.

Task 8. Finalize System Design and Report
The process system design will be finalized and a final report will be written summarizing the results of the project. Completion Date: December 2003.



Project Partners

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